Appendix A-Information on other invasive species in Kawaguesaga and Minocqua Lakes

Curly leaf pondweed

The seriousness of curly leaf pondweed infestation is somewhat unclear. The lack of clarity on the issue rests on the likelihood of further spread of curly leaf pondweed throughout Spooner Lake, and the resultant impacts on native plants and fish and wildlife habitat. A related question is whether treatment in the form of herbicide application is likely to be effective for long-term, whole lake control and if the result will cause more harm than good to native plant populations. Clear answers regarding these potential impacts are not available. However, it is unlikely that herbicide application will result in complete elimination of curly leaf pondweed. It is possible that management can reduce the spreading of the non-native plant, especially in the main portion of the lake. In the management area (east bay), the growth of curly leaf pondweed is so extensive that treatment would probably have minimal impact and would have adverse affects on the native plant community.

Curly leaf pondweed is specifically designated as an invasive aquatic plant (along with Eurasian water milfoil and purple loosestrife) to be the focus of a statewide program to control invasive species in Wisconsin. Invasive species are defined as a "non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (23.22(c)."

The Wisconsin Comprehensive Management Plan for Aquatic Invasive Species describes curly leaf pondweed impacts as follows:

> It is widely distributed throughout Wisconsin lakes, but the actual number of waters infested is not known. Curly-leaf pondweed is native to northern Europe and Asia where it is especially well adapted to surviving in low temperature waters. It can actively grow under the ice while most plants are dormant, giving it a competitive advantage over native aquatic plant species. By June, curly-leaf pondweed can form dense surface mats that interfere with aquatic recreation. By mid-summer, when other aquatic plants are just reaching their peak growth for the year, it dies off. Curly-leaf pondweed provides habitat for fish and invertebrates in the winter and spring when most other plants are reduced to rhizomes and buds, but the mid-summer decay creates a sudden loss of habitat. The die-off of curly-leaf pondweed also releases a surge of nutrients into the water column that can trigger algal blooms and create turbid water conditions. In lakes where curly-leaf pondweed is the dominant plant, the summer die-off can lead to habitat disturbance and degraded water quality. In other waters where there is a diversity of aquatic plants, the breakdown of curly-leaf may not cause a problem.[1]

The state of Minnesota DNR web site explains that curly leaf pondweed often causes problems due to excessive growth. At the same time, the plant provides some cover for fish and some waterfowl species feed on the seeds and winter buds.[2]

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[1] Wisconsin's Comprehensive Management Plan To Prevent Introductions and Control Existing Populatins of Aquatic Invasive Species. Prepared by: Wisconsin Department of Natural Resource. September 2003.
[2] Information from Minnesota DNR (www.dnr.state.mn.us/aquatic_plants).

The following description is taken from a Great Lakes Indian Fish and Wildlife Commission handout.

Curly leaf pondweed (*Potamogeton crispus*)[3]

Identification:

Curly leaf pondweed is an invasive aquatic species found in a variety of aquatic habitats, including permanently flooded ditches and pools, rivers, ponds, inland lakes, and even the Great Lakes. Curly leaf pondweed prefers alkaline or high nutrient waters 1 to 3 meters deep. Its leaves are strap-shaped with rounded tips and undulating and finely toothed edges. Leaves are not modified for floating, and are generally alternate on the stem. Stems are somewhat flattened and grow to as long as 2 meters. The stems are dark reddish-green to reddish-brown, with the mid-vein typically tinged with red. Curly leaf pondweed is native to Eurasia, Africa and Australia and is now spread throughout most of the United States and southern Canada.

Characteristics:

New plants typically establish in the fall from freed turions (branch tips). The winter form is short, with narrow, flat, relatively limp, bluish-green leaves. This winter form can grow beneath the ice and is highly shade-tolerant. Rapid growth begins with warming water temperatures in early spring – well ahead of native aquatic plants.

Reproduction and dispersal:

Curly leaf pondweed reproduces primarily vegetatively. Numerous turions are produced in the spring. These turions consist of modified, hardened, thorny leaf bases interspersed with a few to several dormant buds. The turions are typically 1.0 – 1.7 cm long and 0.8 to 1.4 cm in diameter. Turions separate from the plant by midsummer, and may be carried in the water column supported by several leaves. Humans and waterfowl may also disperse turions. Stimulated by cooler water temperatures, they germinate in the fall, over-wintering as a small plant. The next summer they mature, producing reproductive tips of their own. Curly leaf pondweed rarely produces flowers.

Ecological impacts:

Rapid early season growth may form large, dense patches at the surface. This canopy overtops most native aquatic plants, shading them and significantly slowing their growth. The canopy lowers water temperature and restricts absorption of atmospheric oxygen into the water. The dense canopy formed often interferes with recreational activities such as swimming and boating.

In late spring, curly leaf pondweed dies back, releasing nutrients that may lead to algae blooms. Resulting high oxygen demand caused by decaying vegetation can adversely affect fish populations. The foliage of curly leaf pondweed is relatively high in alkaloid compounds possibly making it unpalatable to insects and other herbivores.

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[3] Information from GLIFWC Plant Information Center (http://www.glifwc.org/epicenter).

Curly leaf pondweed control:
Small populations of curly leaf pondweed in otherwise un-infested water bodies should be attacked aggressively. Hand pulling, suction dredging, or spot treatments with contact herbicides are recommended. Cutting should be avoided because fragmentation of plants may encourage their re-establishment. In all cases, care should be taken to remove all roots and plant fragments, to keep them from re-establishing.

Flowering rush[4]
Flowering rush is a perennial aquatic herb that emerges each spring from winter-hardy rhizomes. Emergent leaves are stiff, narrow and sedge like and up to three feet above the water surface. In deep water, the plan can be entirely submerged. Submerged plants have limp leaves and do not flower. Often unnoticed among other wetland plants until it blossoms, flowering rush has a distinctive flower with pink, white or purple flowers. The flowers have three petals, three sepals, and red anthers when blooming in late summer to early fall.

Flowering rush resembles bur-reed (*Sporangium sp*.) and can be mistaken.

This plant was brought from Asia as an ornamental and has escaped water gardens. It prefers shallow or slow moving water where it grows as an emergent plant in marshes, backwaters and along shorelines. Plants spread by underground rhizomes, forming dense stands and crowding out native species. Reproduction from seed is uncommon.

Accurate identification of flowering rush when not flowering is important when using control methods (due to resemblance to native plants). Plants can be cut below the surface several times during the summer. They will re-sprout, but will eventually decrease in abundance. Small populations can be dug out by hand, carefully removing all root fragments. Small reproductive structures can break off and spread to other areas when the root system is disturbed. All plants and plant parts should be composted away from the aquatic environments. Use of chemical herbicides requires a permit from the Wisconsin DNR.

Purple loosestrife[5]
Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. The flowers are showy and vary inform purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, and attached to square stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe. It is still promoted by some for use as a landscape plant and by beekeepers for its nectar producing capability. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and

[4] Information from Wisconsin DNR invasive species factsheet. http://dnr.wi.gov/invasives/fact/rush_flowering.htm 2008
[5] http://dnr.wi.gove/invasives/fact/loosestife purple.htm. 2008

vegetative propagation. The absence of natural predators also contributes to its proliferation in North America.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions.

Purple loosestrife spreads mainly by seed, but can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%. Seeds submerged in water can live for approximately 20 months. Vegetative spread through local perturbation is also characteristic of loosestrife, clipped, trampled, or buried stems of established plants may produce shoots and roots. It is difficult to locate non-flowering plants so monitoring should be done at the beginning of the flowering period in mid-summer.

Any sunny or partially shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil acclerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

<u>Control of purple loosestrife</u>
Small young plant can be hand pulled, especially in loose soil. It is important to get the entire root. Older plants are generally too big for pulling and digging up. If this is the case, chemical treatment may be necessary. When pulling by hand, handle plants prior to onset of seeds (begins early August). Removed plant parts should be dried and disposed of properly.

Careful use of herbicide can be effective for large plants. Glycophosphate (Roundup or Rodeo commercially named) is the most effective active ingredient for killing purple loosestrife. It needs to be applied in late July or August. It is used as a 1% concentration. Glycophosphate is nonselective and will kill other vegetation. Therefore, care must be taken during application so as to not apply to non-target plants.

A promising long-term treatment is biological control using insects that feed on loosestrife causing death to the plants. Six different insect species has gained U.S. approval for release as biological control of purple loosestrife.

Appendix B-Management options for Aquatic Plants from Wisconsin DNR

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
No Management	N	Do not actively manage plants	Minimizing disturbance can protect native species that provide habitat for aquatic fauna; protecting natives may limit spread of invasive species; aquatic plants reduce shoreline erosion and may improve water clarity	May allow small population of invasive plants to become larger, more difficult to control later
			No immediate financial cost	Excessive plant growth can hamper navigation and recreational lake use
			No system disturbance	May require modification of lake users' behavior and perception
			No unintended effects of chemicals	
			Permit not required	
Mechanical Control	May be required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics	Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore	Immediate results	Not selective in species removed
		Harvest invasives only if invasive is already present throughout the lake	EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting	Fragments of vegetation can re-root
			Minimal impact to lake ecology	Can remove some small fish and reptiles from lake
			Harvested lanes through dense weed beds can increase growth and survival of some fish	Initial cost of harvester expensive
			Can remove some nutrients from lake	
Biological Control	Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year	Effectiveness will vary as control agent's population fluctates
			Lowers density of problem plant to allow growth of natives	Provides moderate control - complete control unlikely
				Control response may be slow
				Must have enough control agent to be effective
a. Weevils on EWM	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem	Need to stock large numbers, even if some already present
			Selective control of target species	Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines
			Longer-term control with limited management	Bluegill populations decrease densities through predation

Management Options for Aquatic Plants

Draft updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Pathogens	Y	Fungal/bacterial/viral pathogen introduced to target species to induce mortality	May be species specific	Largely experimental; effectiveness and longevity unknown
				May provide long-term control	Possible side effects not understood
				Few dangers to humans or animals	
c.	Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long-term, maintenance-free control	Initial transplanting slow and labor-intensive
				Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth	Spikerushes native to WI, and have not effectively limited EWM growth
					Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d.	Planting native plants	Y	Diverse native plant community established to repel invasive species	Native plants provide food and habitat for aquatic fauna	Initial transplanting slow and labor-intensive
				Diverse native community may be "resistant" to invasive species	Nuisance invasive plants may outcompete plantings
				Supplements removal techniques	Largely experimental; few well-documented cases
					If transplants from external sources (another lake or nursery), may include additional invasive species or "hitchhikers"

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Physical Control	Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Fabrics/ Bottom Barriers	Y	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas	Eliminates all plants, including native plants important for a healthy lake ecosystem
			Useful for small areas	May inhibit spawning by some fish
				Need maintenance or will become covered in sediment and ineffective
				Gas accumulation under blankets can cause them to dislodge from the bottom
				Affects benthic invertebrates
				Anaerobic environment forms that can release excessive nutrients from sediment
b. Drawdown	Y, May require Environmental Assessment	Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes	Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
		Season or duration of drawdown can change effects	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	May impact attached wetlands and shallow wells near shore
			Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced
			Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLF)	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning
			Restores natural water fluctuation important for all aquatic ecosystems	Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians
				Navigation and use of lake is limited during drawdown

Management Options for Aquatic Plants

Draft updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
c.	Dredging	Y	Plants are removed along with sediment	Increases water depth	Severe impact on lake ecosystem
			Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
			For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
			Extensive planning required		Sediment testing may be necessary
					Removes benthic organisms
					Dredged materials must be disposed of
d.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Effects to microscopic organisms unknown
e.	Non-point source nutrient control	N	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Requires landowner cooperation and regulation
				Native plants may be able to better compete with invasive species in low-nutrient conditions	Improved water clarity may increase plant growth

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Chemical Control	Y, Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae	Some flexibility for different situations	Possible toxicity to aquatic animals or humans, especially applicators
		Results usually within 10 days of treatment, but repeat treatments usually needed	Some can be selective if applied correctly	May kill desirable plant species, e.g. native water-milfoil or native pondweeds; maintaining healthy native plants important for lake ecology and minimizing spread of invasives
		Chemicals must be used in accordance with label guidelines and restrictions	Can be used for restoration activities	Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration
				May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape
				Often controversial
a. 2,4-D	Y	Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue	Moderately to highly effective, especially on EWM	May cause oxygen depletion after plants die and decompose
		Applied as liquid or granules during early growth phase	Monocots, such as pondweeds (e.g. CLP) and many other native species not affected	May kill native dicots such as pond lilies and other submerged species (e.g. coontail)
			Can be selective depending on concentration and seasonal timing	Cannot be used in combination with copper herbicides (used for algae)
			Can be used in synergy with endothol for early season CLP and EWM treatments	Toxic to fish
			Widely used aquatic herbicide	

Management Options for Aquatic Plants

Draft updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Endothall	Y	Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis	Especially effective on CLP and also effective on EWM	Kills many native pondweeds
			Applied as liquid or granules	May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring	Not as effective in dense plant beds; heavy vegetation requires multiple treatments
				Can be selective depending on concentration and seasonal timing	Not to be used in water supplies; post-treatment restriction on irrigation
				Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds	Toxic to aquatic fauna (to varying degrees)
				Limited off-site drift	
c.	Diquat	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning	Mostly used for water-milfoil and duckweed	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads
			Applied as liquid, can be combined with copper treatment	Rapid action	Toxic to aquatic invertebrates
				Limited direct toxicity on fish and other animals	Must be reapplied several years in a row
					Ineffective in muddy or cold water (<50°F)
d.	Fluridone	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis	Effective on EWM for 1 to 4 years with aggressive follow-up treatments	Affects non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations
			Must be applied during early growth stage	Some reduction in non-target effects can be achieved by lowering dosage	Requires long contact time at low doses: 60-90 days
			Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Slow decomposition of plants may limit decreases in dissolved oxygen	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments
			Applied at very low concentration at whole lake scale	Low toxicity to aquatic animals	In shallow eutrophic systems, may result in decreased water clarity
					Unknown effect of repeat whole-lake treatments on lake ecology

Management Options for Aquatic Plants

Draft updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
e.	Glyphosate	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants such as purple loosestrife	RoundUp is often incorrectly substituted for Rodeo - Associated surfactants of RoundUp believed to be toxic to reptiles and amphibians
			Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Cannot be used near potable water intakes
			Applied as liquid spray or painted on loosestrife stems	Non-toxic to most aquatic animals at recommended dosages	Ineffective in muddy water
				Effective control for 1-5 years	No control of submerged plants
f.	Triclopyr	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher doses (e.g. coontail)
			Applied as liquid spray or liquid	More effective on dicots, such as purple loosestrife; may be more effective than glyphosate	May be toxic to sensitive invertebrates at higher concentrations
				Control of target plants occurs in 3-5 weeks	Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)
				Low toxicity to aquatic animals	Sensitive to UV light; sunlight can break herbicide down prematurely
				No recreational use restrictions following treatment	Relatively new management option for aquatic plants (since 2003)
g.	Copper compounds	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
			Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment	Short-term results
			Wisconsin allows small-scale control only	Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Long-term effects of repeat treatments to benthic organisms unknown
					Toxic to invertebrates, trout and other fish, depending on the hardness of the water
					Clear water may increase plant growth

[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.
[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.
[3]Broad-spectrum herbicide - Affects both monocots and dicots.
[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.
Specific effects of herbicide treatments dependent on timing, dosage, duration of treatment, and location.
References to registered products are for your convenience and not intended as an endorsement or criticism of that product versus other similar products.
This document is intended to be a guide to available aquatic plant control techniques, and is not necessarily an exhaustive list.
Please contact your local Aquatic Plant Management Specialist when considering a permit.

Appendix C-Funding sources

Potential Funding Sources for Aquatic Invasive Species Monitoring, Planning, etc.

Grant Program: AIS Grant
Wisconsin Department of Natural Resources
Program Goals/Objectives: control aquatic invasive species
Eligible Applicants: Qualified lake and river management organizations and qualified school districts
Eligible Project Elements: education, prevention, and planning; early detection and response; controlling established infestations
Funding limits and rate: 75% of project costs up to $75,000 for education, prevention, planning and controlling established infestations; 75% of project costs up to $10,000 for early detection and rapid response
Application Deadline: February 1st of each year
Contact: Kevin Gauthier 715.365.8937

Grant Program: Lake Planning
Wisconsin Department of Natural Resources
Program Goals/Objectives: collect information in order to manage lakes
Eligible Applicants: Qualified lake and local government organizations; qualified school districts
Eligible Project Elements: Monitoring and education; organization development; studies or assessments.
Funding limits and rate: Small scale-75% share costs with a cap of $3000; large scale-75% share costs with a cap of $10,000.
Application Deadline: Feb 1st and August 1st of each year.
Contact: Kevin Gauthier 715.365.8937

Potential Funding Sources for Watershed Practices

SHORELINE BUFFERS AND INFILTRATION PRACTICES

Grant Program: Lake Protection
Wisconsin Department of Natural Resources
Program Goals/Objectives: lake protection and restoration
Eligible Applicants: Qualified lake and conservation organizations
Eligible Project Elements: plans and specifications, earth moving and structure removal, native plants and seeds, monitoring costs
Funding Limits and Rates: 75 % of project costs up to $100,000
Application Deadline: May 1st each year
Contact: Kevin Gauthier 715.365.8937

Appendix D-Eurasian water milfoil coordinates from July 2007 macrophyte survey

Kawaguesaga Lake

Sample pt	Coordinates		Density
443	45.8756883	-89.73989097	1
872	45.86659783	-89.72832527	1
885	45.87613505	-89.7269129	2
886	45.87565803	-89.72691524	3
900	45.87661044	-89.72622762	2
922	45.87470071	-89.72555407	V
949	45.8713599	-89.72488762	1
992	45.86896983	-89.72285084	2
996	45.86706174	-89.72286032	1

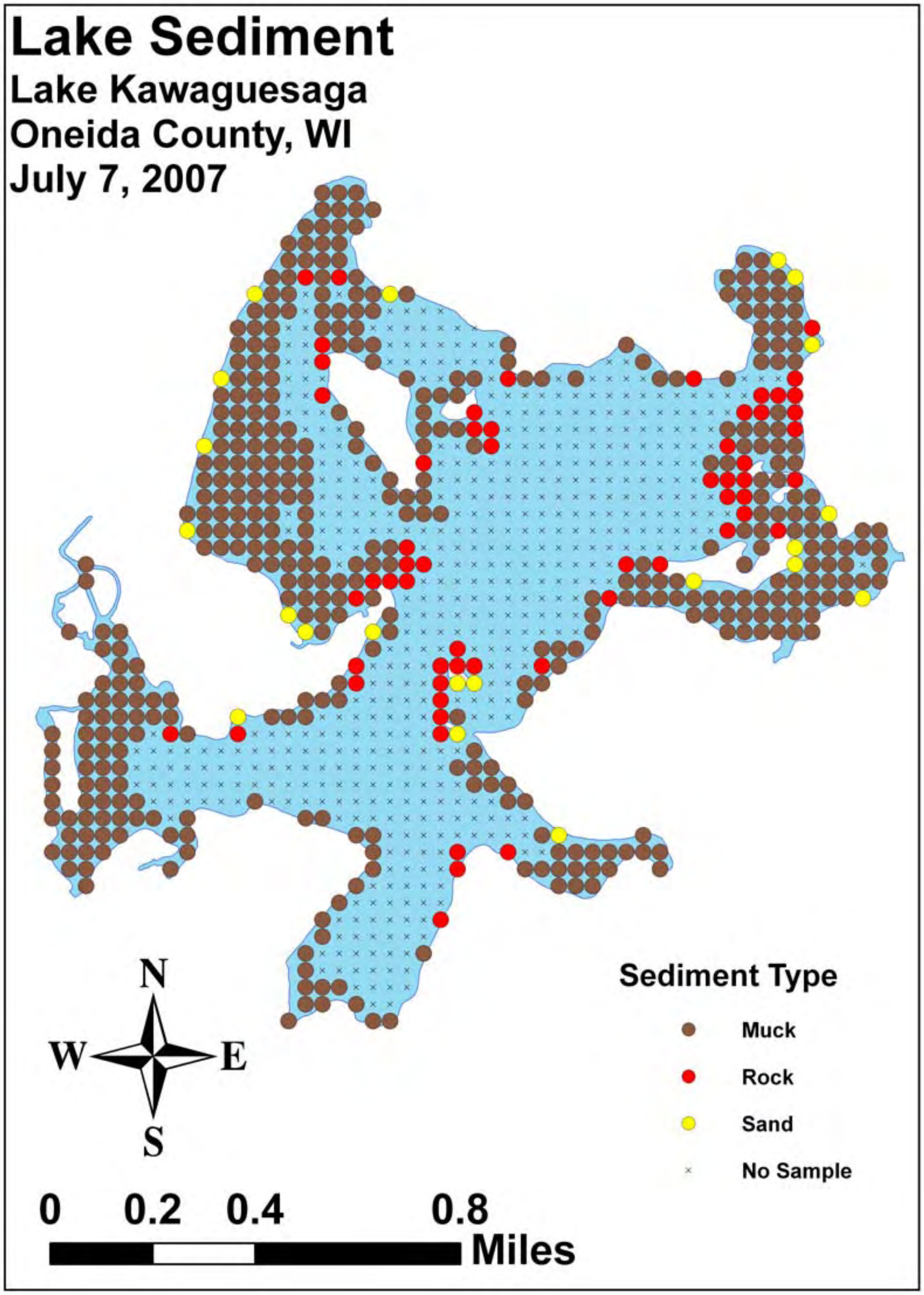
Minocqua Lake

Sample pt	Coordinates		Density
2	45.87496989	-89.7186652	v
7	45.87496831	-89.71802094	v
14	45.85966755	-89.71809829	2
15	45.85921753	-89.71810056	2
32	45.86101603	-89.71744736	1
33	45.860566	-89.71744964	1
35	45.85966596	-89.7174542	1
47	45.87091492	-89.71675298	v
70	45.85741425	-89.71682153	1
158	45.856511	-89.71553799	v
229	45.87090851	-89.71417609	1
442	45.85875143	-89.71166203	1
478	45.86189996	-89.71100163	v
530	45.87314725	-89.70965483	v
533	45.8659469	-89.70969232	2
588	45.86504357	-89.7084087	1
589	45.85829324	-89.70844399	v
592	45.88304278	-89.70767018	1
593	45.88259276	-89.70767254	1
611	45.87449238	-89.70771502	v
642	45.86819043	-89.70710385	v
682	45.88213778	-89.70574185	v
683	45.88168776	-89.70574423	v
684	45.88123774	-89.7057466	v
685	45.88078772	-89.70574898	1
696	45.86953719	-89.70580835	1
697	45.86908717	-89.70581073	v
717	45.86953553	-89.70516415	v
718	45.86908551	-89.70516653	2
720	45.86818546	-89.70517128	1
734	45.87763425	-89.70447701	v
738	45.86773378	-89.70452948	1
740	45.86683373	-89.70453425	1
746	45.8641336	-89.70454855	3
747	45.86773211	-89.7038853	v
757	45.86593035	-89.70325069	2

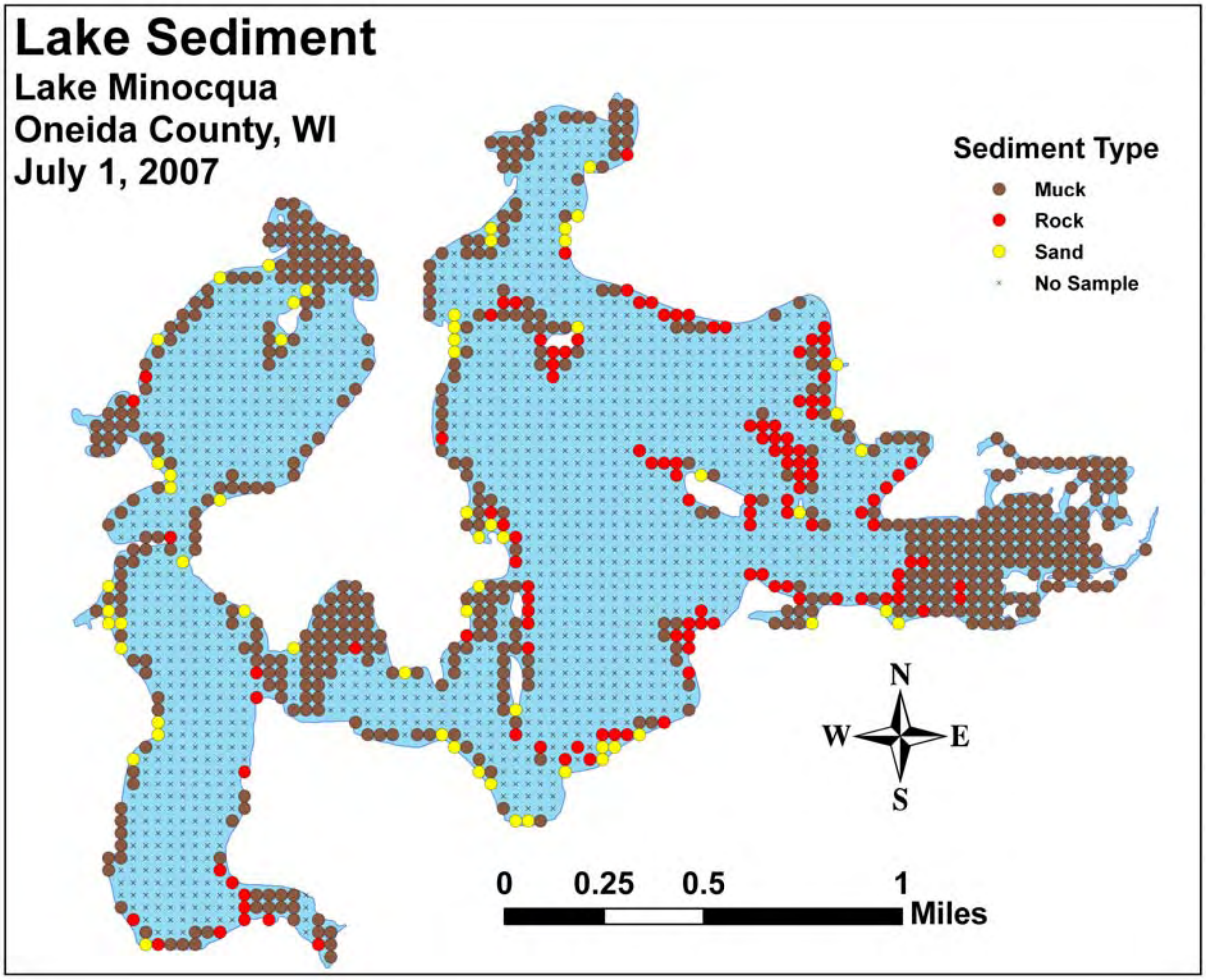
761	45.86413026	-89.70326027	3
767	45.86412859	-89.70261613	1
904	45.88571777	-89.69799015	v
997	45.88526433	-89.69670382	1
1448	45.88704887	-89.69089437	1

Appendix E-Substrate conducive EWM sites

Eurasian water milfoil will tend to grow well in mucky, high nutrient sediments. Note the locations of the muck sediment on Kawaguesaga Lake.



Note the locations of muck sediment on Minocqua Lake.



Appendix F-Pre and Post Treatment Survey Protocol-Wisconsin DNR

Pre and Post AIS Chemical Herbicide Treatment Monitoring
(May 2007)

Purpose

This protocol is used to determine the need for, and evaluate the results of herbicide application to reduce aquatic invasive plant species. The following protocol is applicable for introducing new treatments to lakes where the treatment size is greater than 10 acres or greater than 10% of the lake littoral area and more than 150 feet from shore as well as any AIS grant funded treatments or where performance results are needed where restoration is a goal i.e. for science or for financial accountability. This protocol is written for Eurasian water-milfoil (EWM) but can be adapted for Curly-leaf Pondweed and other AIS. This protocol may be appropriately adapted to evaluate non-herbicide controls. The adaptation will retain the goal of science and financial accountability of AIS grant funded projects.

Proposed treatment surveys. To determine:
- Target areas where EWM is found and within which treatment is proposed for a conditional APM permit
- Target and native species presence/absence and abundance.

Pre-treatment surveys. To determine:
- The extent of the AIS both in distribution and density – refinement of proposed treatment areas.
- The need for an herbicide treatment or whether another method of control is more appropriate at this time.
- Cost of treatment both in product and labor.
- Proper acreage for permit conditions and public notice.
- Adjustments in application rates based on proximity to native plants.

Post-treatment surveys: To determine:
- The effectiveness of the herbicide application, both in density and distribution.
- If herbicide is the desired control method.
- The response of native plants.
- If adjustments need to be made to application rates.
- Future direction of plant management activities

Protocol for Established Infestations

Base YR

Recent (within 5 years) summer point/intercept (P/I) survey to characterize entire plant community and identify potential treatment areas.

YR 1 Season before treatment (may be base year)

1. *Proposed treatment survey.*

a. During the summer growing season map areas as polygons using GPS to outline beds and pinpoint individual target plants.
    i. The initial Point/Intercept survey is unlikely to identify every stand of EWM. The sponsor or applicant must use additional, less formal strategies to find stands of this invasive such as:
        1. Define beds by sub-sampling with a rake at greater frequencies (to determine presence only around the points where target plants were found).
        2. If clarity is good (to the depth of rooted plants) and bed is topped out, identification can be visual but thoroughly augmented with rake tosses to verify species.
        3. For lower clarity waters, sub sample with a rake on a series of denser points. Augmenting with scuba and underwater video is highly recommended.
        4. Boat or walk around the shoreline looking for the invasive in the shallow water areas. EWM is less likely to be found on hard sediments, but may occur anywhere.
        5. Look for plant fragments wind-rowed on shore as indication plants floated in from further off shore.
        6. When trying to see into the water, use brown polarized sun glasses or use an Aqua-View Scope.

b. Confirm EWM with vouchers, 1 per large (> 5 acres) treatment area or polygon or site visit by DNR personnel (who should also voucher).

c. In order to assess the effect of chemical treatment on natives, there must be a survey of <u>all</u> plant species before treatment. However, since natives will be largely absent at the time of the spring pre-treatment survey, the natives must be assessed the summer before treatment. Therefore, after defining the proposed treatment polygons (1a), perform a presence/absence and rake fullness assessment of all plants at a sub sample of points within and near the polygons determined by:
    i. A reference table. Sample polygons greater than 5 acres unless the proposed treatment areas are smaller than 5 acres

Acres of Polygon	# of Sampling Points
0.50	1
1.00	4
2.00	8
3.00	12
4.00	16
5.00	20
7.00	28
10.00	40
15.00	60
20.00	80
30.00	120

40.00	160
50.00	200

YR 2 First treatment

2. *Pre-treatment Survey*
   a. Using the established *proposed treatment* polygons from YR 1, repeat the methods in proposed treatment survey as needed sampling only for EWM to confirm the appropriateness of the treatment area. Plants will be small, and may be very sparse this time of year. Underwater visual/video of the middle and edges of the proposed polygon is highly recommended.

3. CONDUCT TREATMENT after the target specie is actively growing but before native species are active. Generally, this will be prior to water temp of 60 degrees F. Best results are generally obtained when biomass is still low, thus earlier treatment within the treatment time window is better than later.

4. *Post-treatment Survey*. Conducted at least four weeks after treatment For CLP, post treatment survey needs to be completed before CLP seasonal growth ends. For EWM, post treatment should be delayed until native plants are well established, generally during mid-July-mid-August. For the summer post-treatment survey, repeat steps 1.c. This will be used to identify effectiveness on target plants, determine if there was any harm or benefits to native plants and identify next year's potential treatment areas for target plants.
   a. Compare summer surveys. If there are chemical treatments in subsequent years, compare summer surveys for treatment effects on natives and long-term effects on target species.

5. Conduct visual survey to look for new colonies.

YR3 and Yr 4

6. Repeat YR 2 procedure. Be sure to resample all areas treated in all years even if treatment area declines in size over time so that an accurate record of control *and results* can be established.

YR 5

7. Repeat YR 2 procedure if necessary.
8. Conduct a lake wide P/I survey (repeat base year) to gauge overall lake community response.

Notes :

Summer to summer post treatment comparison is for assessing native and target species response.

Conversely spring to spring is for assessing target AIS response. Comparing spring to fall in the same year is not a valid assessment of native response. A fall survey may be added, however, to locate potential new EWM spring treatment areas.

Once established and repeated monitoring indicates that the beds of target species stay in the same location year to year and only density varies, pre-treatment surveys on repeated nuisance control treatments may be less rigorous.

During initial P/I survey of lake, assess weevil damage, northern water milfoil abundance and shoreland habitat and consider need for treatment or scale of treatment given bio-control potential. Use CLMN (Herman) guidance on weevil monitoring.

The plant surveys should be conducted by an independent party not directly affiliated with the herbicide applicator to prevent bias or appearance of bias.

Measuring success or the need to change course.

- Chose a percent decrease in the target plant area coverage or frequency of occurrence for an annual goal of at least 50% for restoration projects.
- For an overall long term goal, a reduction to less than large scale treatment (less than 10 acres or 10% of lake littoral area) where annual spot treatments can sustain low level occurrences is reasonable. Alternatively, a goal of reducing dense beds to scattered plants using a density measurement might be appropriate.
- Acceptable native response is no net loss and ideally some gain. However, some loss may be purely sampling variance or inter-annual variation.

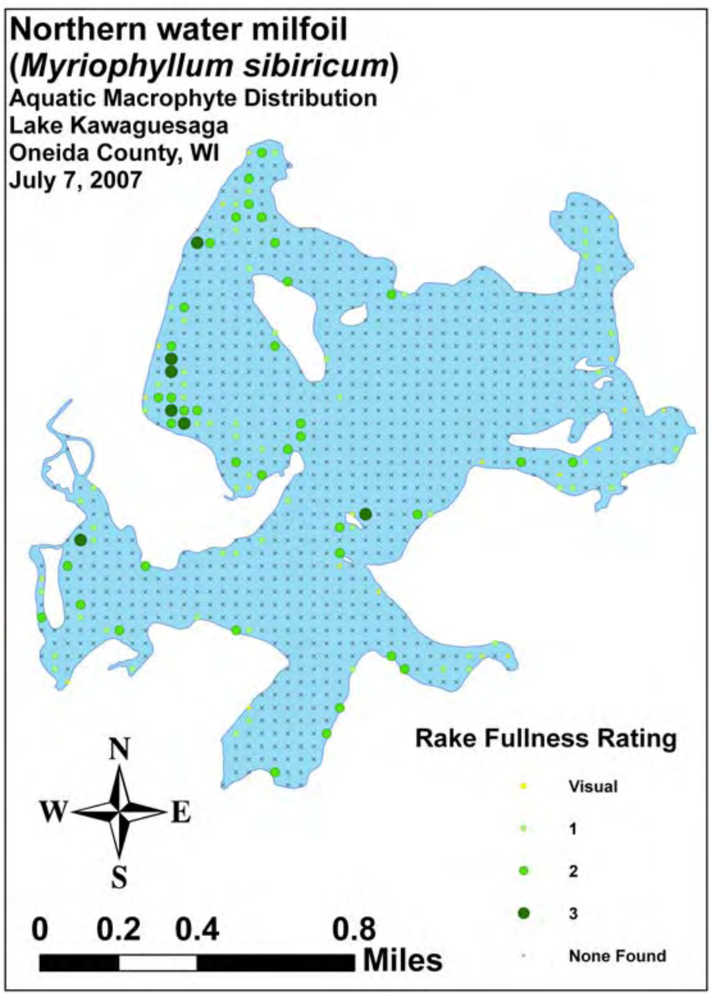
Appendix G-Northern water milfoil locations

Kawaguesaga Lake

Sample pt	Coordinates		Density
2	45.86284037	-89.75428935	V
3	45.86236335	-89.75429145	1
5	45.8614093	-89.75429566	2
11	45.85997675	-89.75361922	1
12	45.85949973	-89.75362133	1
17	45.86331446	-89.75292169	2
26	45.85902123	-89.7529407	V
27	45.86617513	-89.75222619	0
28	45.8656981	-89.75222831	1
29	45.86474405	-89.75223255	0
30	45.86426703	-89.75223466	3
35	45.8618819	-89.75224526	2
36	45.86140488	-89.75224738	1
40	45.86617365	-89.75154337	1
43	45.86474257	-89.75154974	1
44	45.86426554	-89.75155187	1
62	45.86092488	-89.75088399	1
70	45.86092339	-89.75020124	2
80	45.85949082	-89.74952491	1
81	45.86950685	-89.74879706	V
82	45.86902982	-89.74879921	1
83	45.86330552	-89.74882499	2
91	45.87141344	-89.74810558	V
94	45.86998237	-89.74811204	1
95	45.86950534	-89.7481142	2
103	45.87284301	-89.74741621	1
106	45.87141193	-89.7474227	2
107	45.87093491	-89.74742486	3
108	45.87045789	-89.74742702	3
110	45.86950384	-89.74743134	2
111	45.86902681	-89.7474335	3
112	45.86854979	-89.74743566	2
121	45.8728415	-89.74673332	2
122	45.87236447	-89.74673548	1
126	45.87045637	-89.74674415	1
127	45.86997935	-89.74674631	1
128	45.86950233	-89.74674848	1
129	45.8690253	-89.74675065	2
130	45.86854828	-89.74675281	3
138	45.8752251	-89.74603955	3
151	45.86902379	-89.7460678	2
152	45.86854676	-89.74606997	1
158	45.86139139	-89.74610254	1
161	45.87522358	-89.74535662	2
175	45.86854524	-89.74538712	1
184	45.87665313	-89.74466714	V
206	45.86377347	-89.74472611	1
215	45.8766516	-89.74398419	1
216	45.87617458	-89.74398639	2

232	45.86854219	-89.74402143	1
233	45.86806517	-89.74402362	1
235	45.86711112	-89.744028	2
237	45.86615707	-89.74403237	1
239	45.86377194	-89.74404332	1
245	45.86090979	-89.74405645	2
246	45.85709359	-89.74407396	1
250	45.87855816	-89.74329246	v
252	45.87760412	-89.74329686	2
253	45.87712709	-89.74329905	1
254	45.87665007	-89.74330125	2
259	45.87426495	-89.74331223	1
275	45.86663256	-89.74334736	1
276	45.86615554	-89.74334956	V
284	45.86090826	-89.7433737	1
285	45.85804611	-89.74338687	V
286	45.85756908	-89.74338906	1
291	45.87855663	-89.74260949	2
296	45.87617151	-89.74262051	2
311	45.86758507	-89.74266014	1
313	45.86663102	-89.74266454	2
315	45.8642459	-89.74267554	1
329	45.87855509	-89.74192652	1
334	45.87521592	-89.74194198	2
337	45.87187675	-89.74195744	1
338	45.87139973	-89.74195964	2
366	45.85565791	-89.74203246	2
372	45.87378331	-89.74126569	2
380	45.86758199	-89.74129447	2
383	45.86567389	-89.74130332	1
415	45.86853449	-89.74060719	2
416	45.86805747	-89.74060941	2
488	45.8709165	-89.73923035	1
517	45.85708279	-89.73929502	2
529	45.86948387	-89.73855418	1
539	45.86471363	-89.73857655	2
541	45.86375958	-89.73858102	2
542	45.86328255	-89.73858325	V
553	45.85803528	-89.73860784	2
573	45.86518909	-89.7378915	V
574	45.86471206	-89.73789375	1
585	45.85946479	-89.7379184	1
605	45.86518752	-89.7372087	3
638	45.8623238	-89.73653941	V
645	45.87329378	-89.73580467	2
670	45.8599371	-89.73586794	2
671	45.8732922	-89.73512177	1
695	45.85945849	-89.73518746	2
713	45.86518121	-89.73447748	2
735	45.86517962	-89.73379467	1
758	45.85945373	-89.73313926	1
794	45.85992756	-89.73177149	1
795	45.85945053	-89.73177379	1
811	45.86708132	-89.73105425	V
812	45.85992595	-89.73108875	V
828	45.86040137	-89.73040371	1
844	45.85992273	-89.72972327	V

858	45.86707648	-89.72900577	2
898	45.86659458	-89.72695962	v
899	45.86611755	-89.72696196	1
915	45.86706997	-89.72627446	2
917	45.86611592	-89.72627914	1
920	45.87565475	-89.72554937	1
921	45.87517773	-89.72555172	1
922	45.87470071	-89.72555407	1
935	45.86706833	-89.72559163	1
943	45.87422204	-89.7248735	1
951	45.87040586	-89.72489233	1
954	45.86754371	-89.72490645	V
958	45.87612849	-89.72418115	V
967	45.87183528	-89.72420238	1
969	45.87088123	-89.7242071	V
979	45.866111	-89.72423069	1
984	45.86897149	-89.72353369	V
989	45.86658637	-89.72354551	1
1001	45.86896651	-89.72148514	V
1009	45.86753378	-89.72080945	1



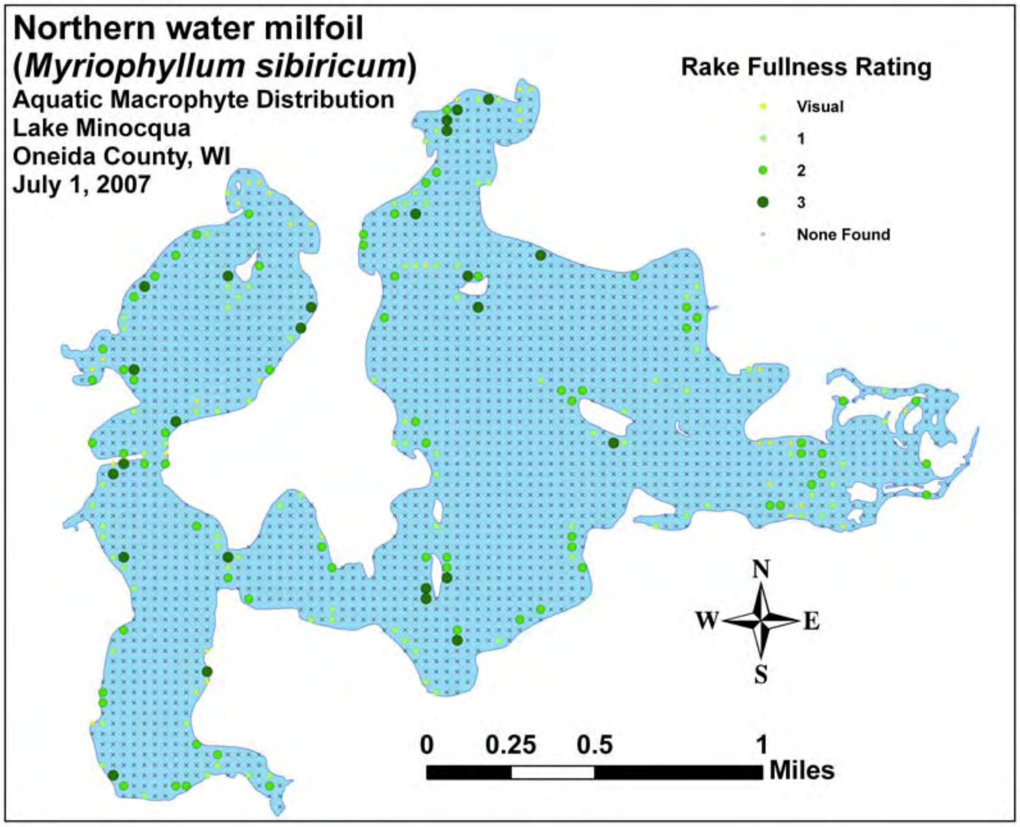
Minocqua Lake

Sample pt	Coordinates		Density
7	45.87496831	-89.71802094	v
8	45.87451828	-89.71802321	2
9	45.87181815	-89.71803687	2
11	45.86911802	-89.71805052	1
14	45.85966755	-89.71809829	v
17	45.87586676	-89.7173721	2
18	45.87541674	-89.71737439	v
24	45.87001647	-89.71740176	1
28	45.86821639	-89.71741088	1
29	45.86776636	-89.71741316	1
32	45.86101603	-89.71744736	2
33	45.860566	-89.71744964	2
35	45.85966596	-89.7174542	1
39	45.85786587	-89.71746332	1
47	45.87091492	-89.71675298	V
48	45.8704649	-89.71675526	3
56	45.86686472	-89.71677355	1
58	45.86281452	-89.71679411	1
70	45.85741425	-89.71682153	3
72	45.87721363	-89.71607667	1
73	45.87676361	-89.71607897	1
77	45.87496352	-89.71608813	2
81	45.87136335	-89.71610646	2
82	45.87091332	-89.71610875	3
91	45.86686313	-89.71612937	3
92	45.8664131	-89.71613166	1
93	45.86371297	-89.71614541	2
108	45.85696263	-89.71617975	2
111	45.87811207	-89.71542779	2
118	45.87496192	-89.71544386	3
119	45.8745119	-89.71544616	2
121	45.87316183	-89.71545305	1
138	45.86551146	-89.71549209	1
160	45.87856048	-89.71478118	3
176	45.87136014	-89.71481801	1
177	45.87091012	-89.71482031	2
209	45.8565094	-89.71489393	1
211	45.87900889	-89.71413456	2
279	45.87225696	-89.71352494	2
280	45.87180694	-89.71352725	1
281	45.87135692	-89.71352956	v
282	45.87090689	-89.71353187	2
330	45.87270536	-89.71287838	3
358	45.85695458	-89.71295946	2
399	45.8596531	-89.71230147	1
405	45.85695296	-89.7123154	2
406	45.8808025	-89.71154799	2
422	45.87360216	-89.71158524	v
423	45.87315214	-89.71158757	1
425	45.8682019	-89.71161317	2
441	45.86100155	-89.7116504	v
442	45.85875143	-89.71166203	2
446	45.88080087	-89.71090366	1

477	45.86280001	-89.71099697	v
478	45.86189996	-89.71100163	3
479	45.86144994	-89.71100397	v
482	45.85739974	-89.71102495	1
500	45.87314888	-89.71029908	1
502	45.86774862	-89.71032713	1
503	45.8672986	-89.71032947	1
508	45.85829815	-89.71037621	2
509	45.85784813	-89.71037855	1
510	45.88259769	-89.70960561	1
517	45.87899752	-89.70962436	3
518	45.8785475	-89.70962671	1
520	45.87764746	-89.7096314	1
531	45.86684694	-89.70968764	3
532	45.86639692	-89.70968998	1
533	45.8659469	-89.70969232	2
539	45.88214603	-89.7089636	V
545	45.87809584	-89.70898475	1
556	45.8668453	-89.70904346	1
563	45.88304443	-89.70831454	V
566	45.88169437	-89.70832161	2
571	45.87854422	-89.70833809	1
582	45.87359399	-89.70836399	1
588	45.86504357	-89.7084087	2
591	45.85739319	-89.70844869	1
592	45.88304278	-89.70767018	V
600	45.87944261	-89.70768906	2
611	45.87449238	-89.70771502	V
623	45.88259111	-89.70702819	V
640	45.87494075	-89.70706839	2
650	45.8573899	-89.70716056	1
651	45.85693988	-89.70716292	2
669	45.86908882	-89.70645492	1
684	45.88123774	-89.7057466	V
695	45.87628751	-89.70577273	1
716	45.87673587	-89.70512607	3
717	45.86953553	-89.70516415	1
729	45.88123441	-89.70445792	V
734	45.87763425	-89.70447701	3
746	45.8641336	-89.70454855	1
747	45.86773211	-89.7038853	V
748	45.86728209	-89.70388769	2
756	45.86638037	-89.7032483	2
760	45.86458029	-89.70325788	1
761	45.86413026	-89.70326027	1
775	45.88077601	-89.70123864	2
776	45.88032599	-89.70124105	2
795	45.87447404	-89.70062814	1
812	45.87717247	-89.69996935	2
829	45.882121	-89.69929836	1
830	45.88167098	-89.69930078	2
836	45.87897086	-89.69931535	2
850	45.87177053	-89.69935418	1
862	45.86367014	-89.69939785	1
863	45.88211931	-89.69865401	1
869	45.87941918	-89.6986686	1
884	45.87266887	-89.69870509	1

886	45.87176883	-89.69870995	1
902	45.86321842	-89.69875614	1
905	45.88256763	-89.69800722	1
907	45.88166759	-89.69801209	3
912	45.87941748	-89.69802428	1
927	45.87266717	-89.69806085	2
945	45.8627667	-89.69811444	1
949	45.88481602	-89.69735065	1
950	45.88301594	-89.69736042	2
952	45.8821159	-89.69736531	1
958	45.87941578	-89.69737997	V
975	45.87176543	-89.69742149	2
986	45.86546513	-89.69745567	3
987	45.86501511	-89.69745811	3
995	45.86141493	-89.69747764	1
997	45.88526433	-89.69670382	1
1000	45.88346425	-89.69671361	2
1009	45.87941407	-89.69673565	1
1027	45.8713137	-89.69677971	1
1029	45.87041365	-89.6967846	1
1032	45.86816355	-89.69679684	1
1044	45.8609632	-89.69683598	1
1045	45.88616266	-89.69605452	2
1046	45.88571264	-89.69605698	3
1047	45.88526262	-89.69605943	3
1088	45.86681177	-89.69616	2
1089	45.86636175	-89.69616246	2
1090	45.86591173	-89.69616491	3
1102	45.88661097	-89.69540767	V
1103	45.88616095	-89.69541013	3
1118	45.87941064	-89.69544701	1
1121	45.87806058	-89.69545439	1
1153	45.86365991	-89.69553303	2
1154	45.86320989	-89.69553549	3
1177	45.8789589	-89.69480516	3
1216	45.88660752	-89.69411887	1
1224	45.88300736	-89.69413862	1
1233	45.87895718	-89.69416085	2
1235	45.87760712	-89.69416825	3
1269	45.8866058	-89.69347446	3
1277	45.88300564	-89.69349426	1
1318	45.88660407	-89.69283006	1
1361	45.86320299	-89.69295896	1
1405	45.88705061	-89.69153877	V
1407	45.88615057	-89.69154375	1
1408	45.88570055	-89.69154624	V
1446	45.86409957	-89.69166573	2
1448	45.88704887	-89.69089437	V
1490	45.87984681	-89.69028997	3
1502	45.87444657	-89.69031997	1
1524	45.8645461	-89.69037495	2
1573	45.87399305	-89.68903396	2
1608	45.87354127	-89.68839222	2
1620	45.86814102	-89.6884224	1
1621	45.867691	-89.68842491	2
1622	45.86724098	-89.68842743	2
1623	45.86679096	-89.68842994	1

1640	45.87398953	-89.68774545	2
1654	45.86633918	-89.68778829	2
1671	45.87218769	-89.6871113	1
1717	45.87173413	-89.68582537	3
1738	45.87308242	-89.68517352	1
1739	45.87173236	-89.68518114	1
1746	45.87893091	-89.68449617	2
1799	45.87442714	-89.68323311	1
1811	45.86812685	-89.6832689	1
1867	45.87802193	-89.68127975	1
1868	45.87757191	-89.68128233	2
1870	45.87667187	-89.68128747	2
1876	45.87397175	-89.68130291	1
1888	45.8685715	-89.68133377	1
1892	45.87847015	-89.68063287	1
1895	45.87712009	-89.68064061	2
1898	45.87577003	-89.68064834	1
1930	45.86901792	-89.68004281	1
1972	45.87486094	-89.67743218	1
1985	45.87485912	-89.67678791	V
1989	45.87170898	-89.67680617	V
2001	45.87170715	-89.67616195	V
2005	45.86990707	-89.6761724	V
2007	45.86900703	-89.67617763	2
2017	45.86900521	-89.67553343	2
2019	45.8717035	-89.67487349	V
2020	45.87125348	-89.67487611	1
2026	45.86855335	-89.67489186	V
2027	45.87170166	-89.67422926	2
2028	45.87125164	-89.67423189	2
2033	45.86900154	-89.67424504	V
2034	45.86855152	-89.67424767	1
2039	45.86989974	-89.67359557	2
2040	45.86944972	-89.67359821	1
2044	45.87124796	-89.67294345	2
2046	45.87034792	-89.67294873	2
2050	45.86854784	-89.67295928	1
2057	45.86989605	-89.67230716	1
2059	45.86899601	-89.67231245	1
2063	45.87349436	-89.67164175	2
2067	45.87079425	-89.67165765	1
2073	45.86809412	-89.67167355	V
2103	45.87393695	-89.66906209	1
2104	45.87258689	-89.6690701	1
2119	45.87303317	-89.66777895	V


Northern water milfoil
(Myriophyllum sibiricum)
Aquatic Macrophyte Distribution
Lake Minocqua
Oneida County, WI
July 1, 2007
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.25
0.5
1
Miles

Appendix H-Shoreline assessment

Date:	Lake:																			
						Shoreline (feet)					Buffer Shoreline to 35' Back (square feet)				Total	Non				
Parcel	Lat	Long	Length	RipRap	Struct	Lawn	Rock	Sand	Nat	Lawn	Hard Sur	Sand	Cleared	Natural	Sq Ft	Stru	Elev	Logs		Comm
Shoreline																				
This is the condition of the shoreline where the water meets the land at																				
the ordinary water level.																				
Natural	At the waters edge there is natural vegetation. If there is a small strip of sand say																			
	less than one foot, before the vegetation, call it natural vegetation																			
Sand	Either natural or man made beach																			
Rock	A natural rock shoreline																			
RipRap	Rock put there by man																			
Structures	Man made impervious surfaces such as boat launches or boat houses. Column heading "Struct"																			
Lawn	Obviously planted or natural that is routinely mowed																			
Buffer																				
This is the area from the shoreline to 35 feet into the property																				
Natural	Just that trees, brush and other vegetation that is natural																			
Hard	Can be boat houses, boat launches, house roofs, decks and the like. Anything that																			
Surfaces	prevents rain water from soaking into the soil. Open stairs are considered cleared. Column heading "Hard Surf"																			
Cleared	An area that is primarily cleared but not mowed. It could contain a																			
	few trees or shrubs. Include open stairs here.																			
Lawn	Grass or vegetation that is obviously mowed. It could contain a																			
Sand	Natural sand or a sand hauled in																			
Other Data																				
Elevation	Three categories should be enough; s=steep, m=moderate, f= mostly flat. Column heading "Elv"																			
Non	Structures such as storage sheds, boat houses and residences that are																			
Conform	within the 75 foot set back. Column heading " Non Stru"																			
Comments	Any comments of interest such as erosion, junk and the like.																			

Appendix I -2008 Post season treatment analysis

Plot	Point	Depth	Myriophyllum spicatum EWM	Brasenia schreberi,Watershield	Ceratophyllum demersum,Coontail	Elodea canadensis,Common waterweed	Heteranthera dubia,Water star-grass	Megalodonta beckii,Water marigold	Myriophyllum sibericum,Northern water milfoil	Potamogeton amplifolius,Large-leaf pondweed	Potamogeton pusillus,Small pondweed	Potamogeton richardsonii,Clasping-leaf pondweed	Potamogeton robbinsii,Robbins pondweed	Potamogeton zosteriformis,Flat-stem pondweed	Ranunculus aquatilis,Stiff water crowfoot	Vallisneria americana,Wild celery	Potamogeton praelongis Whitestem	Najas flexilis, Bushy pondeweed
1	1	5.8	2		1	1										1		
1	2	5.9	2	1	1								1	1	1	1		
2	3	6.4	3		1									1		1		
3	4	7.5	3		1													
4	5	7.1	3		1	1	1		1		1	1						
5	6	13.3	2		1													
6	7	8.9	3		1				1					1				
7	8	5.2	2		1			1	1			1		1				
10	9	10.1	2		1									1				
10	10	9.3	1		1	1						1				1		
10	11	7.2	2		1	1				1				1	1	1		
2008																		
Plot	Point	Depth																
1	1	5.8	2			1						1	1			1		

1	2	5.9	1		1						1		
2	3	6.4	3				1			1	1		
3	4	7.5	2			1							
4	5	7.1	3			1							
5	6	13.3	0	1	1					1			
6	7	8.9	2										1
7	8	5.2	3	1	1								
10	9	10.1	3	1									
10	10	9.3	0	1				1				1	
10	11	7.2	1	1	1				2				1

ttest

EWM 08	EWM 07
2	2
1	2
3	3
2	3
3	3
0	2
2	3
3	2
3	2
0	1
1	2

P= 0.068829

not significant

Note: More points for comparing 2009 to 2009 were added. They will be included in that analysis. These were the points for 2007 that were used. Also, the spreadsheet for analyzing significance of treatment provided by the Wisconsin DNR will be used.

Protocol for shoreline assessment:

When completing the shoreline assessement, it is helpful to have a parcel map of the lake properties. This allows a listing of each parcel and may reduce the amount of time needed to complete the survey. It is also helpful to have a laser distance measurement tool to quickly measure distances.

Tools needed:

GPS receiver
Laser distance measurement device
Data entry spreadsheet
100 ft tape measure
boat

Procedure:

1. Locate parcel boundaries as best that can be done.
2. Mark the beginning and ending coordinates of the parcel and record.
3. Measure the number of feet of various shoreline types (refer to spreadsheet).
4. Total all measurements to get total distance of shoreline.
5. Measure or estimate 35 feet in from shore to determine the “buffer zone” area.
6. Estimate the square footage (area) of various surfaces (see spreadsheet) in the “buffer zone” area.
7. Determine the area of the total “buffer zone” by multiplying 35 ft by the distance of parcel shoreline.
8. When completed calculate the total shoreline, total of various shoreline types, total buffer area and total of buffer surfaces.
9. All various types can be expressed as a percentage.

Appendix J – Glossary of terms (from the University of Wisconsin-Extension Aquatic Plant Management manual)

Algae — Small aquatic plants containing chlorophyll and without roots that occur as single cells or multi-celled colonies. Algae form the base of the food chain in aquatic environments.

Algal bloom — A heavy growth of algae in and on a body of water as a result of high nutrient concentrations.

Alkalinity — The acid combining capacity of a (carbonate) solution, also describes its buffering capacity.

Aquatic Invasive Species (AIS) — Refers to species of plants or animals that are not native to a particular region into which they have moved or invaded. Zebra mussels and Eurasian water-milfoil are examples of AIS. Wisconsin has laws preventing the spread on boats and trailers.

Aquatic plant survey — a systematic mapping of types and location of aquatic plants in a water body, usually conducted by means of a boat. Survey information is presented on an **aquatic plant map**.

BMP's (Best Management Practices) — practices or methods used to prevent or reduce amounts of nutrients, sediments, chemicals or other pollutants from entering water bodies from human activities. BMP's have been developed for agricultural, forestry, construction, and urban activities.

Bathymetric map — a map showing depth contours in a water body. Bottom contours are usually presented as lines of equal depth, in meters or feet. Often called a hydrographic map.

Benthal — Bottom area of the lake (Gr. *benthos* depth).

Biocontrol — management using biological organisms, such as fish, insects or micro-organisms like fungus.

Biomass — The total organic matter present (Gr. *bios* life).

Bottom barriers — synthetic or natural fiber sheets of material used to cover and kill plants growing on the bottom of a water body; also called sediment covers.

Chlorophyll — The green pigments of plants (Gr. *chloros* green, *phyllon* leaf).

Consumers — Organisms that nourish themselves on particulate organic matter (Lat. *consumere* to take wholly).

Contact herbicide — An herbicide that causes localized injury or death to plant tissues with which it contacts. Contact herbicides do not kill the entire plant.

Decomposers — Organisms, mostly bacteria or fungi, that break down complex organic material into its inorganic constituents.

Detritus — Settleable material suspended in the water: organic detritus, from the decomposition of the broken down remains of organisms; inorganic detritus, settleable mineral materials.

Dissolved oxygen — A measure of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish.

Drainage basin — The area drained by, or contributing to, a stream, lake, or other water body (see watershed).

Drawdown — Decreasing the level of standing water in a water body to expose bottom sediments and rooted plants. Water level drawdown can be accomplished by physically releasing a volume of water through a controlled outlet structure or by preventing recharge of a system from a primary external source.

Dredging — A physical method of digging into the bottom of a water body to remove sediment, plants or other material. Dredging can be performed using mechanical or hydraulic equipment.

Ecology — A scientific study of relationships between organisms and their surroundings (environment).

Ecosystems — Any complex of living organisms together with all the other biotic and abiotic (non-living) factors which affect them.

Emergent plants — Aquatic plants that are rooted or anchored in the sediment around shorelines, but have stems and leaves extending well above the water surface. Cattails and bulrushes are examples of emergent plants.

Endothall — The active chemical ingredient of the aquatic contact herbicide Aquathol®.

Epilimnion — The uppermost, warm, well-mixed layer of a lake (Gr. *epi* on, *limne* lake).

Eradication — Complete removal of a specific organism from a specified location, usually refers to a noxious, invasive species. Under most circumstances, eradication of a population is very difficult to achieve.

Euphotic zone — That part of a water body where light penetration is sufficient to maintain photosynthesis.

Eutrophic — Waters with a good supply of nutrients and hence a rich organic production (Gr. *eu* well, *trophein* to nourish).

Exotic — Refers to species of plants or animals that are not native to a particular region into which they have moved or invaded. Eurasian water-milfoil is an exotic plant invader.

Floating-leafed plant — Plants with oval or circular leaves floating on the water surface, but are rooted or attached to sediments by long, flexible stems. Waterlilies are examples of rooted floating-leafed plants.

Fluridone — The active chemical ingredient of the systemic aquatic herbicide SONAR®.

Flushing rate — Term describing rate of water volume replacement of a water body, usually expressed as basin volume per unit time needed to replace the water body volume with inflowing water. The inverse of the flushing rate is the (hydraulic) detention time. A lake with a flushing rate of 1 lake volume per year has a detention time of 1 year.

Freely-floating plants — Plants that float on or under the water surface, unattached by roots to the bottom. Some have small root systems that simply hang beneath the plant. Water hyacinth and tiny duckweed are examples of freely-floating plants.

Glyphosate — The active chemical ingredient of the systemic herbicide RODEO®.

Grass carp — Also known as white amur, grass carp is a large, vegetation-eating member of the minnow family (*Ctenopharyngodon idella*). Originally from Russia and China, these plant grazers are sometimes used as biological agents to control growth of certain aquatic plants. Regulated use of sterile (non-reproducing) grass carp has been recently permitted in Washington State for aquatic plant control.

Herbicide — A chemical used to suppress the growth of or kill plants.

Habitat — The physical place where an organism lives.

Hydraulic detention time — The period of detention of water in a basin. The inverse of detention time is flushing rate. A lake with a detention time of one year has a flushing rate of 1 lake volume per year.

Hypolimnion — The cold, deepest layer of a lake that is removed from surface influences (Gr. *hypo* under, *limne* lake).

Limiting nutrient — Essential nutrient needed for growth of plant organism which is the scarcest in the environment. Oftentimes, in freshwater systems, either phosphorus or nitrogen may be the limiting nutrient for plant growth.

Limnology — The study of fresh water (Gr. *limne* lake).

Littoral — The region of a body of water extending from shoreline outward to the greatest depth occupied by rooted aquatic plants.

Macro-algae — Large, easily seen (macroscopic) algae. The macro-algae *Nitella* sp. sometimes forms dense plant beds and can be a conspicuous member of the aquatic plant community.

Macrophyte — Large, rooted or floating aquatic plants that may bear flowers and seeds. Some plants, like duckweed and coontail, are free-floating and are not attached to the bottom. Occasionally, filamentous algae like *Nitella* sp. can form large, extensive populations and be an important member of the aquatic macrophyte community.

Mitigation — Actions taken to replace or restore animals or plants that may have been damaged or removed by certain prior activities.

Morphology — Study of shape, configuration or form (Gr. *morphe* form, *logos* discourse).

Niche — The position or role of an organism within its community and ecosystem.

Nitrogen — A chemical constituent (nutrient) essential for life. Nitrogen is a primary nutrient necessary for plant growth.

Non point (pollutant) source — A diffuse source of water pollution that does not discharge through a pipe or other readily identifiable structure. Non point pollution typically originates from activities on land and the water. Examples of non point sources are agricultural, forest, and construction sites, marinas, urban streets and properties.

Non-target species — A species not intentionally targeted for control by a pesticide or herbicide.

Noxious weed — A non-native plant species that, because of aggressive growth habits, can threaten native plant communities, wetlands or agricultural lands.

Nutrient — Any chemical element, ion, or compound required by an organism for the continuation of growth, reproduction, and other life processes.

Oligotrophic — Waters that are nutrient poor and have little organic production (Gr. *oligos* small, *trophein* to nourish).

Oxidation — A chemical process that can occur in the uptake of oxygen.

pH — The negative logarithm of the hydrogen ion activity. pH values range from 1-10 (low pH values are acidic and high pH levels are alkaline).

Phosphorus — A chemical constituent (nutrient) essential for life. Phosphorus is a primary nutrient necessary for plant growth.

Photosynthesis — Production of organic matter (carbohydrate) from inorganic carbon and water in the presence of light (Gr. *phos*, *photos* light, *synthesis* placing together).

Phytoplankton — Free floating microscopic plants (algae) (Gr. *phyton* plant).

Point (pollutant) source — A source of pollutants or contaminants that discharges through a pipe or culvert. Point sources, such as an industrial or sewage outfall, are usually readily identified.

Pollutant — A contaminant, a substance that is not naturally present in water or occurs in unnatural amounts that can degrade the physical, chemical, or biological properties of the water. Pollutants can be chemicals, disease-producing organisms, silt, toxic metals, oxygen-demanding materials, to name a few.

Primary production — The rate of formation of organic matter or sugars in plant cells from light, water and carbon dioxide (Lat. *primus* first, *producere* to bring forward). Algae are primary producers.

Problem statement — A written description of important uses of a water body that are being affected by the presence of problem aquatic plants. See Chapter 3.

Producers — Organisms that are able to build up their body substance from inorganic materials (Lat. *producere* to bring forward).

Public Trust Doctrine — A body of law Programs having roots in Roman law, English common law and the North West Ordinance of 1787. It grants authority to the state to regulate it's waters, it establishes public rights of use and defines state property rights in navigable waters.

Residence time — The average length of time that water or a chemical constituent remains in a lake.

Rotovation — A mechanical control method of tilling lake or river sediments to physically dislodge rooted plants. Also known as bottom tillage or derooting.

Secchi disc — A 20-cm (8-inch) diameter disc painted white and black in alternating quadrants. It is used to measure light transparency in lakes.

Sediment — Solid material deposited in the bottom of a basin.

Sensitive areas — Critical areas in the landscape, such as wetlands, aquifer recharge areas, and fish and wildlife habitat conservation areas, that are protected by state law (Growth Management Act of 1990).

Standing crop — The biomass present in a body of water at a particular time.

Steering committee — A small group of people organized to represent the larger community of individuals, businesses and organizations who have an interest in management of a particular water body. The steering committee is responsible for following the planning steps outlined in this manual.

Stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).

Submersed plants — An aquatic plant that grows with all or most of its stems and leaves below the water surface. Submersed plants usually grow rooted in the bottom and have thin, flexible stems supported by the water. Common submersed plants are milfoil and pondweeds.

Susceptibility — The sensitivity or level of injury demonstrated by a plant to effects of an herbicide.

Systemic herbicide — An herbicide in which the active chemicals are absorbed and translocated within the entire plant system, including roots. Depending on the active ingredient, systemic herbicides affect certain biochemical reactions in the plant that can cause plant death. SONAR® and RODEO® are systemic herbicides.

Thermal stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).

Thermocline — (Gr. *therme* heat, *klinein* to slope.) Zone (horizontal layer) in water body in which there is a rapid rate of temperature decrease with depth. Also called metalimnion, it lies below the epilimnion.

Topographic map — A map showing elevation of the landscape in contours of equal height (elevation) above sea level. This can be used to identify boundaries of a watershed.

Transect lines — Straight lines extending across an area to be surveyed.

Tributaries — Rivers, streams or other channels that flow into a water body.

Triclopyr — The active ingredient of a systemic herbicide being evaluated in Washington for aquatic plant control.

Triploid — A genetic term referring to non-reproducing (sterile) forms of grass carp induced by manipulating reproductive genes. Reproducing grass carp have two pairs of chromosomes and are termed diploid. Triploid fish have three sets of chromosomes.

Trophic state — Term used to describe the productivity of the lake ecosystem and classify it as oligotrophic (low productivity, "good" water quality), mesotrophic (moderate productivity), or eutrophic (high productivity; "poor" water quality).

Vascular plant— A vascular plant possesses specialized cells that conduct fluids and nutrients throughout the plant. The xylem conducts water and the phloem transports food.

Water body usage map — A map of a water body showing important human use areas or zones (such as swimming, boating, fishing) and habitat areas for fish, wildlife and waterfowl. See Chapter 7.

Watershed — The entire surface landscape that contributes water to a lake or river. See drainage area.

Watershed management — The management of the natural resources of a drainage basin for the production and protection of water supplies and water-based resources.

Wetland — A generalized term for a broad group of wet habitats. Wetlands are areas of vegetation that are transitional between land and water bodies and range from being permanently wet to intermittently water covered.

Zooplankton — Microscopic animal plankton in water (Gr. *zoion* animal). *Daphnia* sp. or water fleas are freshwater zooplankton.

Thank you to the Washington State Department of Ecology; Maribeth Gibbons Jr.

http://www.ecy.wa.gov/programs/wq/plants/management/manual/

Appendix K-Maps of plant species Kawaguesaga Lake 2007

The plants are in alphabetical order by scientific name.